

WHAT IS CLAIMED IS:

1. An illumination system of apparatus for use in exposing a substrate, the system comprising:

a diaphragm having an adjustable aperture located along an optical axis of the system;

a photoelectric transformation unit having a plurality of photoelectric transformation devices (PTDs) each of which is capable of sensing the energy level of light incident thereon, and the photoelectric transformation unit being operative to output signals indicative of the locations and energy levels of respective portions of light incident on the photoelectric transformation devices thereof;

a drive mechanism connected to and supporting said photoelectric transformation unit and operable to move the photoelectric transformation unit between a first position at which the photoelectric transformation devices are juxtaposed with the aperture of the diaphragm and a second position at which the photoelectric transformation devices are offset from the aperture with respect to the optical axis of the illumination system; and

a controller operatively connected to said photoelectric transformation unit and said diaphragm so as to receive the signals output by the photoelectric transformation unit and set the size of the aperture of the diaphragm based on said signals.

2. The illumination system of claim 1, wherein said first position is one at

which the photoelectric transformation part is disposed face-to-face with said diaphragm at the upstream side thereof with respect to the direction in which light travels along the optical axis in the illumination system, and further comprising an opening/closing sensor operative to sense the degree to which the diaphragm is open, said opening/closing sensor being operatively connected to said controller so as to provide said controller with information indicative of the degree to which the diaphragm is open.

3. The illumination system of claim 2, and further comprising a PTD arranging sensor operative to sense the presence of said photoelectric transformation unit at said first position, said PTD arranging sensor being operatively connected to said controller so as to provide said controller with information indicative of the photoelectric transformation unit being present at said first position.

4. The illumination system of claim 1, wherein said first position is one at which the photoelectric transformation part is disposed face-to-face with said diaphragm at the downstream side thereof with respect to the direction in which light travels along the optical axis in the illumination system.

5. The illumination system of claim 1, wherein the photoelectric transformation part comprises a photoelectric transformation substrate on which the plurality of PTDs are disposed in an array having a dimension, in at least one

direction, that is greater than the maximum diameter of the aperture of said diaphragm, and a support block connected to said drive mechanism and supporting said photoelectric transformation substrate.

6. The illumination system of claim 5, wherein said drive mechanism is a rotary drive mechanism that supports one side of said support block and rotates said photoelectric transformation unit between said first and second positions.

7. The illumination system of claim 5, wherein said drive mechanism is a linear drive mechanism comprising a longitudinally extending guide that supports at least one side of said support block, and a power transfer unit that moves said support block in the longitudinal direction of said guide.

8. The illumination system of claim 1, wherein the photoelectric transformation part comprises a photoelectric transformation substrate in which the plurality of PTDs are disposed in a line having a length greater than the maximum diameter of the aperture of said diaphragm, and a support block connected to the said drive mechanism and supporting the photoelectric transformation substrate.

9. The illumination system of claim 8, wherein said drive mechanism is a linear drive mechanism comprising a longitudinally extending guide that supports at least one side of said support block for sliding movement therealong, a power transfer

unit that drives said support block in the longitudinal direction of said guide, and a position sensor unit including a sensor operative to sense the relative position of said photoelectric transformation substrate in said longitudinal direction.

10. The illumination system of claim 9, wherein said guide is a rack, said linear drive mechanism further comprises a shaft having a central longitudinal axis connected to and extending from the support block parallel to the line of PTDs, and a pinion meshing with said rack and supported by said shaft so as to be rotatable about the central longitudinal axis thereof, and said power transfer unit comprises a motor connected to said pinion so as to rotate said pinion about the central longitudinal axis of said shaft.

11. The illumination system of claim 9, wherein said linear drive mechanism comprises a pair of rollers, said guide is a belt that is to fix said support block and is wrapped around said rollers, and said power transfer unit is a motor connected to at least one of said rollers.

12. The illumination system of claim 9, wherein said guide comprises a rod having a screw thread extending along the length thereof, said linear drive mechanism also includes a nut integral with said support block and mated with the screw thread of said rod, and said power transfer unit is a motor that rotates said rod relative to said nut.

13. The illumination system of claim 1, and further comprising a display connected to said controller so as to display information received from said controller.

14. A method in of establishing an exposure condition in an illumination system for use in exposing a photosensitive film disposed on a substrate, the illumination system including a light source that emits light, optics that project the light along an optical axis, a reticle disposed along the optical axis and having a pattern that diffracts the light, whereby respective orders of the diffracted light undergo constructive interference, and a diaphragm disposed downstream of the reticle with respect to the optical axis and having an adjustable aperture disposed along the optical axis such that orders of the diffracted light pass through the aperture in amounts corresponding to the diameter of the opening of the aperture, said method comprising:

sensing the levels of energy of respective portions of the diffracted light at a location adjacent said diaphragm and producing information correlating said levels to the locations of said portions of light relative to the diaphragm;

on the basis of said information, calculating the energy level of light produced as the result of the constructive interference of those portions of the diffracted light which pass through the aperture of said diaphragm;

on the basis of the calculated energy level, determining a standard size for the aperture of said diaphragm, that will facilitate a desired focus condition of the diffracted light which passes through the aperture of said diaphragm; and

subsequently adjusting the diaphragm until the diameter of the aperture of the diaphragm is of said standard size.

15. The method of claim 14, wherein said sensing of the levels of energy comprises juxtaposing a two-dimensional array of photoelectric transformation devices with the aperture of said diaphragm.

16. The method of claim 14, wherein said sensing of the levels of energy comprises scanning a line of photoelectric transformation devices across the aperture of said diaphragm.

17. The method of claim 14, and further comprising selecting the shape in which the light should be projected, on the basis of the calculated energy level, from among a plurality of different shapes in which the light can be projected by the illumination system.

18. The method of claim 14, and further comprising sensing the size of the opening of the aperture to produce feedback indicative of whether the aperture is of said standard size.

19. A method of exposing a photosensitive film using an illumination system that includes a light source, optics that project the light emitted by the light source

along an optical axis, a reticle disposed along the optical axis and having a pattern that diffracts the light, whereby respective orders of the diffracted light undergo constructive interference, and a diaphragm disposed downstream of the reticle with respect to the optical axis and having an adjustable aperture disposed along the optical axis such that orders of the diffracted light pass through the aperture in amounts corresponding to the diameter of the opening of the aperture, said method comprising:

sensing the levels of energy of respective portions of the diffracted light at a location adjacent said diaphragm and producing information correlating said levels to the locations of said portions of light relative to the diaphragm;

on the basis of said information, calculating the energy level of light produced as the result of the constructive interference of those portions of the diffracted light which pass through the aperture of said diaphragm;

on the basis of the calculated energy level, determining a standard size for the aperture of said diaphragm that will facilitate a desired focus condition of the diffracted light which passes through the aperture of said diaphragm;

subsequently adjusting the diaphragm until the diameter of the aperture of the diaphragm is of said standard size; and

after the diaphragm has been adjusted so that the diameter of the aperture of the diaphragm is of said standard size, aligning a substrate covered with the photosensitive film with the diaphragm and exposing the photosensitive film to light from the illumination system via the aperture of said standard size.